Winter Recreation Safety Guide

U.S. Department of Agriculture
Forest Service
in cooperation with
U.S. Ski Association

Program Aid No. 1140

PREFACE

The Winter Recreation Safety Guide has been developed to inform you of some of the hazards involved in winter recreation and some of the precautions necessary for safe recreational activity.

The Guide was prepared jointly by the Forest Service, U.S. Department of Agriculture, and the United States Ski Association to enhance the safety and enjoyment of winter outdoors. It is intended to provide an overview of winter safety for less experienced people, and to serve as a reminder to the more experienced ones.

ACKNOWLEDGMENTS

Acknowledgment and thanks are directed to the organizations who helped develop this guide.

- SAFECO Insurance Company of America and Mountain Rescue for use of the information in "Four Lines of Defense Against Hypothermia."
- Education and Promotion Committee of the United States Orienteering Federation in cooperation with Orienteering Service, United States Ski Association, for information utilized in "Travel by Map and Compass" section and "Wax Chart."

Issued August 1976

CONTENTS

BASIC GUIDELINES FOR TRAVEL IN THE NATIONAL FORESTS

Many people are unaware of the hazards of winter. Harsh conditions of wind, cold, snow, or whiteout can turn an outing into a tragedy. Knowledge of the area, weather, route, and the limitations of your body and equipment—plus a little common sense—can ensure safe and enjoyable outings.

Before You Leave

Notify a responsible person of your planned route of travel. Mark it on a map. Give your planned time of departure and return. ***Be sure*** to check with that person when you return.

Where To Go

Most of the National Forest land is open for winter travel. However, there are some parts of the National Forests that have restrictions. These restrictions include motorized vehicle closures, avalanche area closures, and hazardous roads. General recreation maps are available from the District Ranger, Forest Supervisor, or Regional offices. Addresses are listed in the back of this publication.

Clothing and Equipment

Layers of clothing, which can be adjusted to prevailing conditions, are best. A good-quality windbreaker jacket and wind pants are excellent. Avoid tight-fitting clothes and boots which may restrict circulation. Take extra socks and gloves or mittens, warm cap, matches in a waterproof container, candle, fire-starter (000 steel wool works well), nylon cord, general-purpose knife, high-energy food, plastic tarp, space blanket, signal mirror, first aid

kit, wide tape for repairs, and metal container for melting snow.

Snowmobilers should be certain to have tools for emergency repairs, extra sparkplugs, and drive belt. Experienced snowmobilers always carry snowshoes (in case of machine failure) as well as the normal emergency and survival gear for winter.

Food and Water

A good rule is "lightweight but loaded," meaning loaded with calories. Plan your meals to ensure a diet of high-energy foods.

Water is often difficult to find in winter. All that is available may be what you carry in containers or melt from snow. The body loses as much as 2 to 4 quarts of fluid per day under exertion. Replacement of fluid loss is very important for maintaining physical condition. Eating snow provides only limited water (10 to 20 percent), drains energy, and cools the body temperature. Avoid melting snow by body contact. Travel equipped to melt snow. Save your energy.

Litter and Sanitation

Litter and debris can mar the quality of a recreation experience—particularly when viewed against a mantle of white snow. Help others enjoy winter travel in National Forests by carrying out what you carry in. Take food in burnable containers or

easily compressed packages that require little space in your gear.

Avoid leaving human waste near any water course. If you are in a group, avoid concentrating wastes. Nature can assimilate only small quantities at a time.

Sharing Routes

In some areas of the National Forests those traveling by skis, snowshoes, and snowmobiles must share the same routes and areas. The following suggestions will help provide safe routes for everyone:

- Operate snowmobiles at minimum speed near skiers or snowshoers. Maintain minimum speed until well beyond those on foot.
- Skiers and snowshoers should realize that snowmobile operators are generally not able to hear other approaching trail users. On steep topography, snowmobiles are generally limited to the developed trail surface. Use common courtesy and respect so that all trail users can enjoy their winter travel.
- Snowmobiles are not permitted on developed ski areas and some trails used for cross-country skiing. Restrictions are posted, but check with the local ranger for full information.

Map and Compass Basics

Knowing the basic principles of map and compass use can enhance winter recreation activities—in terms of new-found trails as well as safe arrival at your planned destination. The same basic skills can be used for land navigation any time of the year.

Maps.—There are two basic types of maps useful for winter travel in National Forests:

- National Forest recreation maps are available from the District Ranger, Forest Supervisor, or Regional offices of the Forest Service, U.S. Department of Agriculture. Addresses of Regional offices are listed in the back of this publication.
- Topographic maps are available from the Regional offices and National Headquarters of the Geological Survey, U.S. Department of the Interior. Addresses are listed in the back of this publication.

Several outdoor recreation and conservation organizations also make useful maps available. Generally, the map information is tailored to the organization's particular interests. These maps can be purchased directly from the organizations and are often available at retail stores specializing in equipment for backpacking, skiing, camping, etc.

Map symbols provide the means for communicating information. Map symbols are used to minimize clutter and facilitate easy reading. Most maps provide an explanation of the symbols under the heading of "Legend." Some of the typical map symbols are illustrated below:

Paved road

Unpaved road

Building

Contour line

Railroad

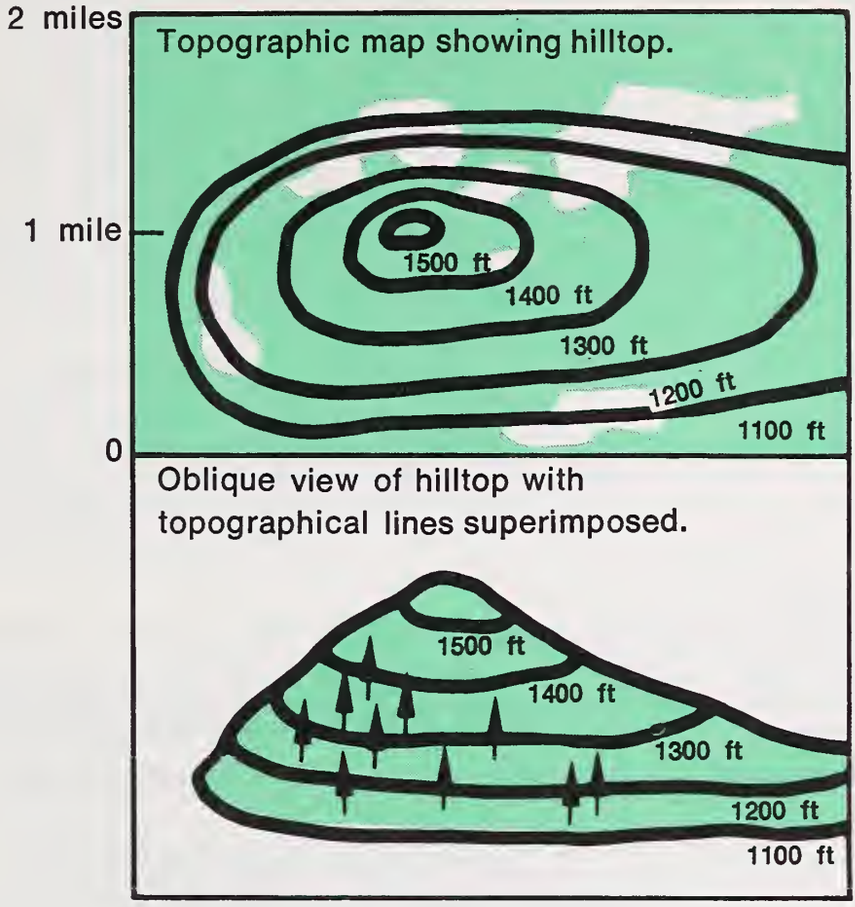
Recreation area

District Ranger Station

Spot elevation × 2069

Contour lines are shown as thin brown lines that connect points

of equal elevation on the ground. By studying the relationship of contour lines a map reader can determine the general shape or form of land. For example, the contour map below represents a hillside and hilltop.



The vertical distance between contour lines is known as the contour interval. In the example above the contour interval is 100 feet. Most maps have the contour interval printed in the map legend or immediately under the map scale.

Contour lines are particularly useful in determining the steepness or slope of a mountainside. The degree or percent of slope is a good indicator of the degree of difficulty in traversing the area by foot, ski, snowshoe, or snowmobile. Slope is also a good indicator for snow avalanche hazard.

Percent of slope is determined by dividing the vertical distance by horizontal distance (between valley bottom and mountain top). For example, the hillside pictured has a vertical distance of 400 feet from top to

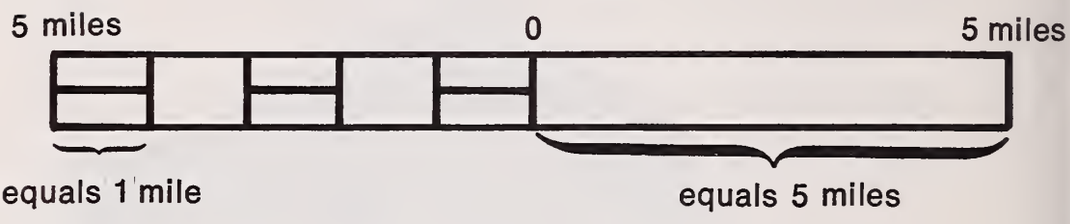
bottom. The horizontal distance is 1 mile or 5,280 feet.

$$\frac{400'}{5{,}280'} = 7.5 \text{ percent slope}$$

Scale is the relationship between distance on the map and actual distance on the ground. Ground distance to your planned destination can be determined from a map through the use of map scale.

Scale information is generally found in the map margin. It is expressed in the form of bar scales, representative fraction, or words and numerals.

Bar scales are divided into miles, meters, yards, or feet. Pictured below is a typical bar scale which uses the mile as a unit of measure.



To measure the straight line distance between two points on a map, lay a straight edge of paper along a line between the two points. Mark the paper at the two points. Then place the strip of paper on the bar scale and read the total distance. Zero to 5 on the right is used for long distances. Zero to 5 on the left is divided into 1 mile units for accurately measuring shorter distances.

The representative fraction is a method of expressing scale in the form of a fraction or ratio. For example, one of the most commonly used USGS topographic maps has a representative fraction (or scale) of 1:24,000. This means that 1 unit of measure on the map is equal to 24,000 of the same units on the ground. The representative fraction (RF) is expressed by the following equation:

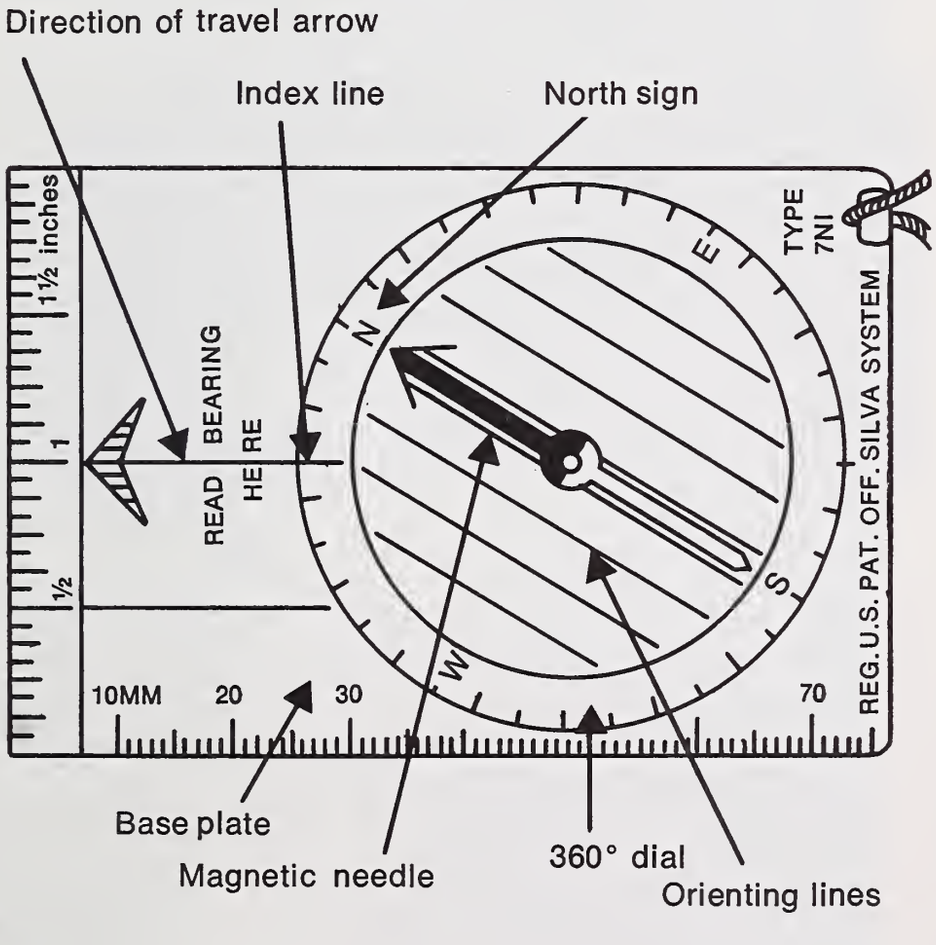
$$RF = \frac{\text{Map distance (MD)}}{\text{Ground distance (GD)}}$$

By applying the equation, any one of the three elements can be found if two parts of the equation are known.

Words and numerals are also used to express scale. It is usually in some convenient unit of measure such as: ½ inch = 1 mile.

To serve as an accurate representation of the landscape, a map should be held or placed so that the map's north arrow points north as indicated by compass. This means that no matter which direction you face, the map should always be oriented north. Graphic symbols used to indicate north generally consist of an arrow or "V" shape together with the initial N. The top edge of a map is almost always oriented north.

Compass.—A compass is a necessary tool for orienting your map and determining your direction of travel. Basic elements of a compass include the following:



There are a variety of other compasses which provide useful

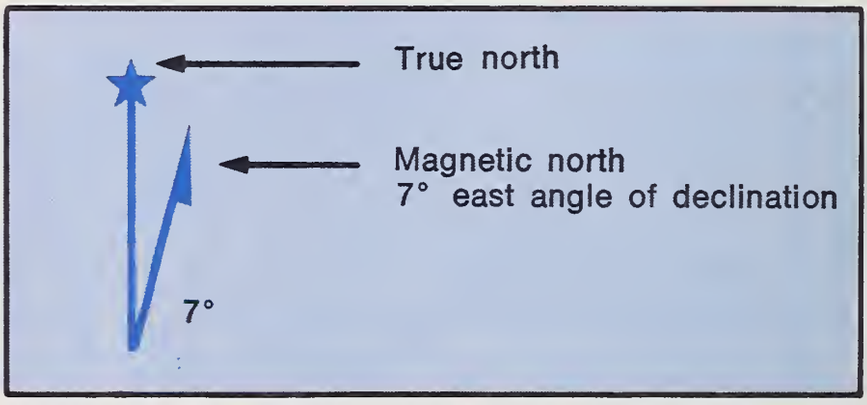
sighting devices. The fundamental design, however, is similar.

The ***angle of declination*** is important to understand. Not knowing the effect of declination (or variation) could cause you to miss your destination point by a wide margin.

Declination is defined as the angle between magnetic north and true north. Two things are important to remember:

- The compass needle always points to ***magnetic north.***
- The difference between magnetic north and true north (in other words, the declination angle) varies according to your geographic location. Example: The declination angle in New Hampshire can be 15° West and in Montana 20° East.

The declination for a given area is generally printed on the map margin adjacent to the north arrow. True north, magnetic north, and declination are shown by the following illustration:



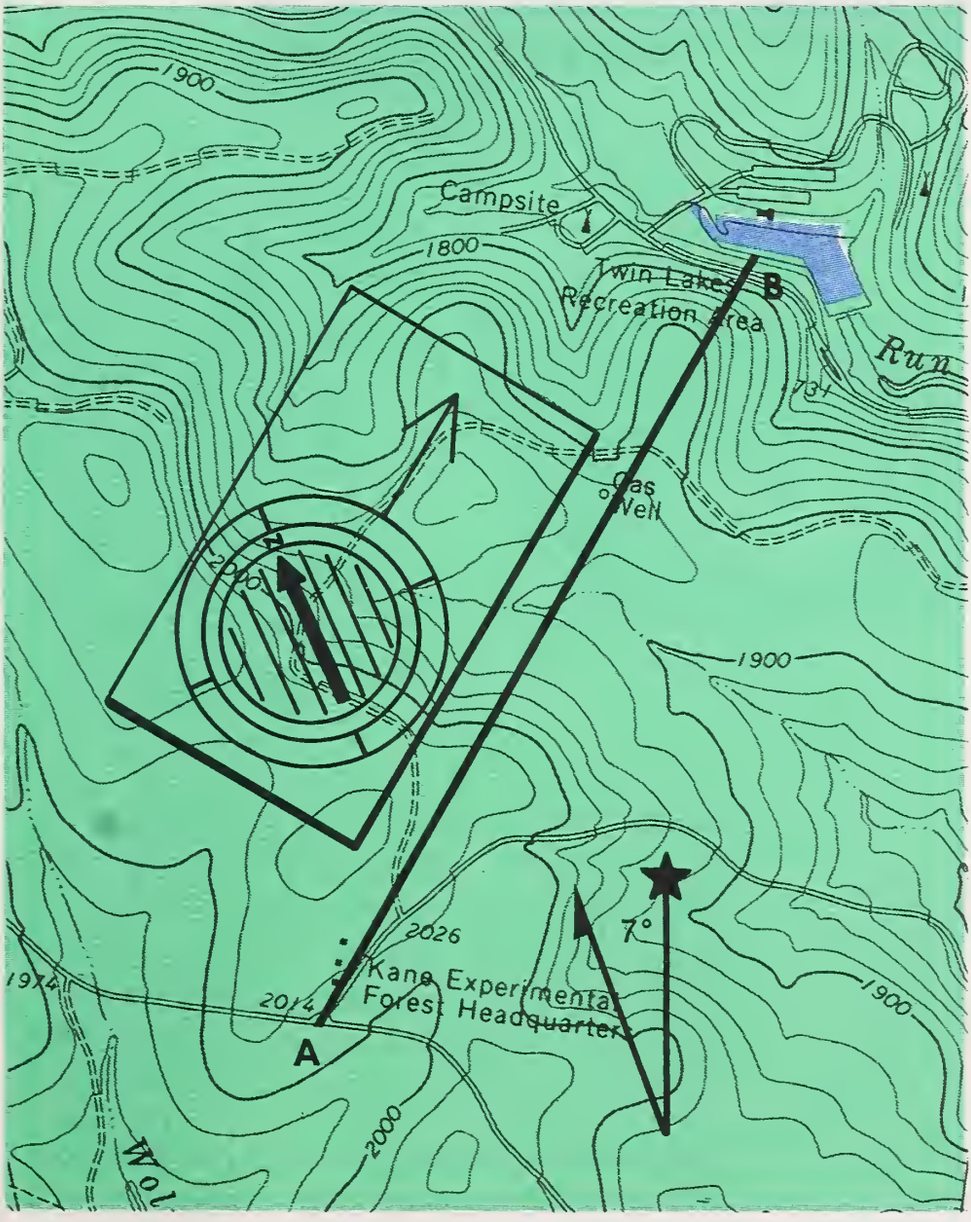
There are several simple methods of compensating for the effects of declination. One method involves projecting parallel magnetic north arrows across the map—using these lines for reference each time a compass reading is made. A second method involves use of a compass which has a declination setting device built in. The third method involves adding or subtracting the angle of declination each time a compass

reading is made. There are minor advantages and disadvantages to each method—the one selected depends on your personal preference. Detailed explanation of the methods can be found in the literature cited in the Map and Compass section of the General Bibliography of Winter Recreation Safety Information.

The following section on Travel by Map and Compass utilizes the third method—adding or subtracting the angles of declination.

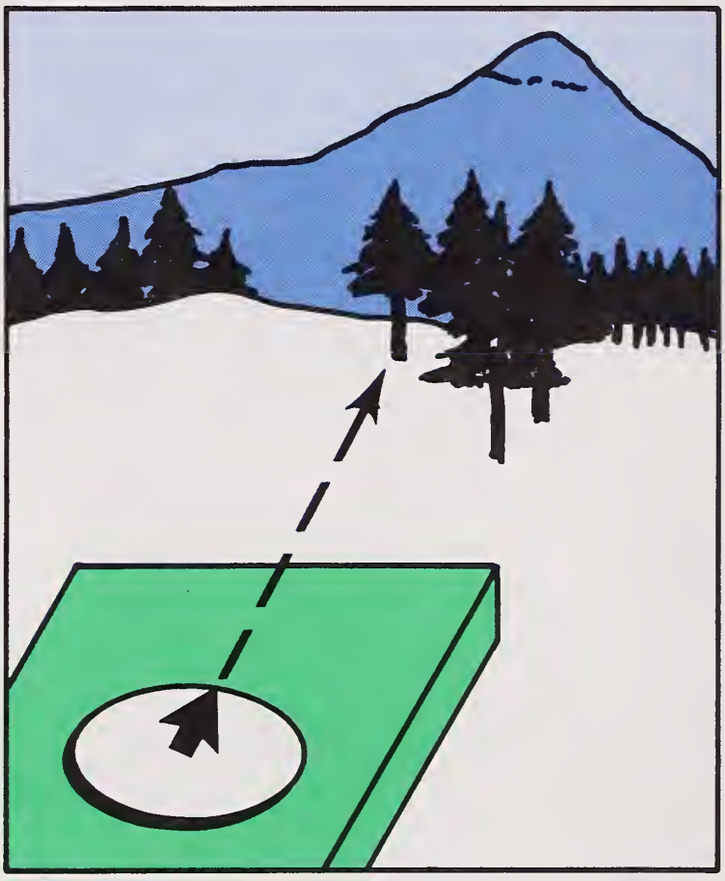
Travel By Map and Compass

Before you set out on an actual trip in the field, several trial runs are recommended. Begin your trial run by selecting a starting point (A) and destination (B). To illustrate the following steps, we have selected the road intersection below as point (A). Point (B) is the shoreline of Twin Lakes.



Step One.—Orient your map to the terrain. The magnetic north arrow on your map should point the same direction as the magnetic needle on the compass.

Step Two.—Place the compass on the map with one long edge of the base plate touching a line between the starting point (A) and destination (B). The direction-of-travel arrow on the compass should be pointing in the direction of the destination point. Holding the base plate firmly, rotate the compass housing till the orienting arrow is in line with the north portion of the compass needle.



Step Three.—Read the setting of the compass dial where it intersects the direction-of-travel line. In the example, the reading is 22°. Determine the angle of declination for your area—in this case, the angle of declination is 7° West.

Step Four.—Add the angle of declination to the compass dial reading,

if declination is West. Subtract if declination is East. To help you remember, learn the rhyme "West is best (add), East is least (subtract)."

Declination for the example is 7° West, therefore 7° is **added** to the compass dial reading of 22° (7° + 22° = 29°). Holding the base plate firmly, rotate the compass to the new reading of 29° for the corrected direction-of-travel.

Step Five.—Look up to see where your direction-of-travel arrow is taking you. Look for a landmark, as far as the terrain will allow, which is in direct line with the direction-of-travel arrow.

Step Six.—Travel towards your chosen landmark object, then repeat steps one through six.

HAZARDS OF WINTER RECREATION

Snow Avalanches

Large and small avalanches can have tremendous force and are a serious threat. The more time that you spend in skiing, snowshoeing, snowmobiling, and other winter activities, the greater are your chances of being caught by snow avalanches.

Understanding the basic types of avalanches and the contributing terrain and weather factors, as well as carefully selecting a safe route, can help you avoid being caught in a snow avalanche. It will also help you survive if you are buried in one.

Snow avalanches are complex natural phenomena. Experts do not fully understand all the causes. It is difficult to predict avalanche conditions with certainty. But the general guidelines in this folder will help a thinking observer develop judgment about the presence and degree of avalanche danger.

Types.—There are two principal types of snow avalanches: loose snow and slab.

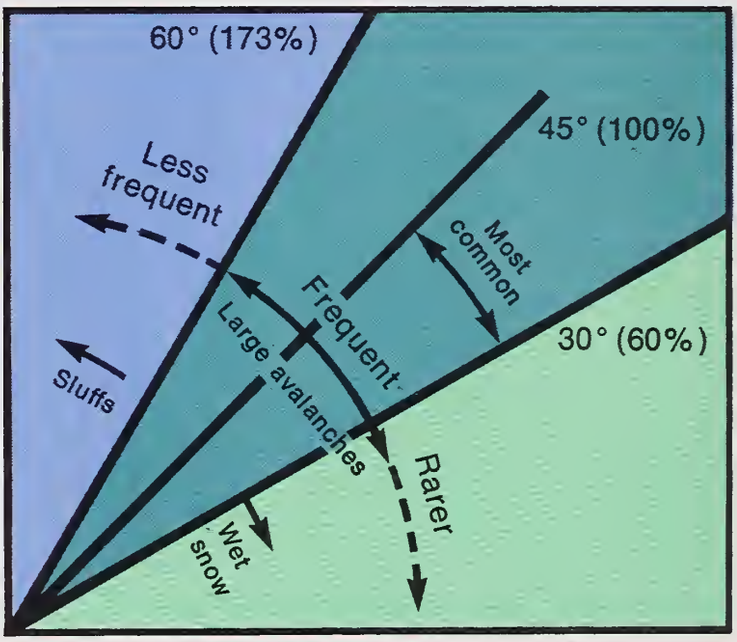
Loose snow avalanches start at a point or over a small area. They grow in size and the quantity of snow involved increases as they descend. Loose snow moves as a formless mass with little internal cohesion.

Slab avalanches, on the other hand, start when a large area of snow begins to slide at once. There is a well-defined fracture line where the moving snow breaks away from the stable snow. Slab avalanches are characterized by the tendency of snow crystals to stick together. There may be angular blocks or chunks of snow in the slide.

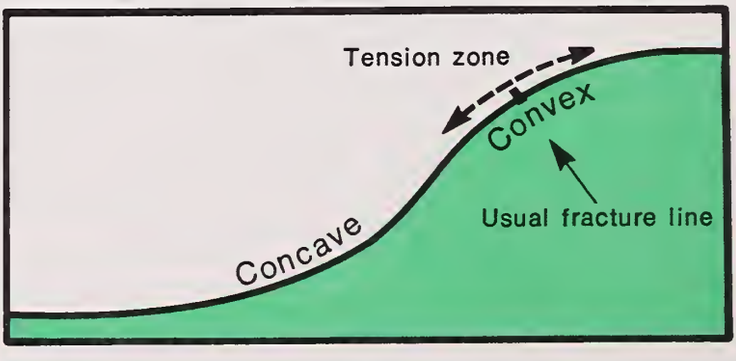
Practically all accidents are caused by slab avalanches. Many times the victims have triggered the avalanche themselves. Their weight on the stressed snow slab is enough to break the fragile bonds that hold it to the slope.

Terrain Factors.—There are four terrain factors affecting snow avalanches: slope steepness, slope profile, slope aspect, and ground cover.

Slope steepness. Avalanches are most common on slopes of 30 to 45 degrees (60 to 100 percent), but large avalanches can occur on slopes ranging from 25 to 60 degrees. The diagram below shows the slopes where avalanches are most common.



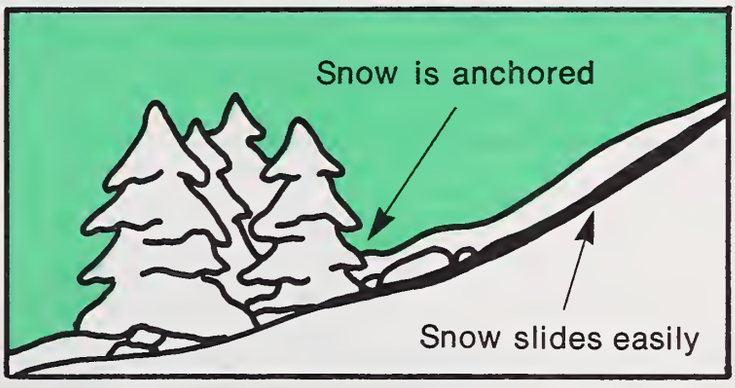
Slope profile. Dangerous slab avalanches are more likely to occur on convex slopes, but may also occur on concave slopes. Short slopes may be as dangerous as long slopes!



Slope aspect. Snow on north-facing slopes is more likely to slide in

midwinter. South-facing slopes are dangerous in the spring and on sunny days. Leeward slopes are dangerous because wind-deposited snows add depth and create hard, hollow-sounding wind slabs. Windward slopes, generally, have less snow; and the snow is compacted, but usually strong enough to resist movement.

Ground cover. Large rocks, trees, and heavy brush help anchor the snow, but avalanches can start even among trees. Smooth, grassy slopes are more dangerous.



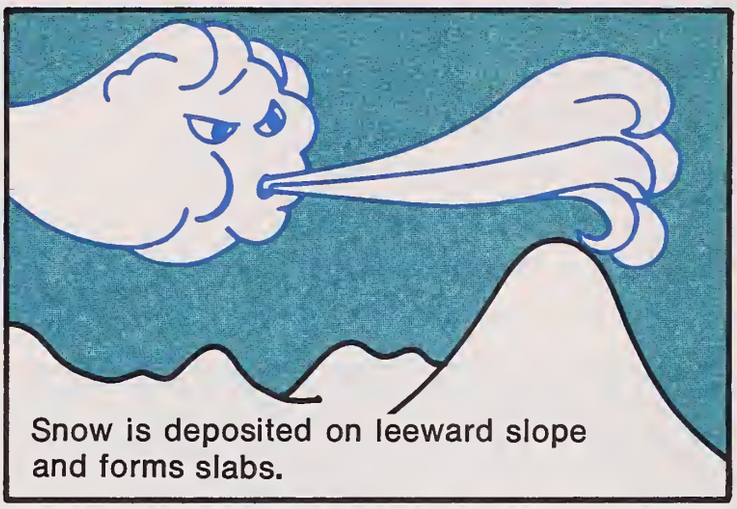
Weather Factors.—Many weather factors affect the chances of a snow avalanche occurring: temperature, wind, storms, rate of snowfall, and types of snow.

Temperature. Snow persists in an unstable condition under cold temperatures. It will settle and stabilize rapidly when temperatures are near, or just above, freezing.

Storms starting with low temperatures and dry snow, followed by rising temperatures, are more likely to cause avalanches. The dry snow at the start forms a poor bond and has insufficient strength to support the heavier snow deposited late in the storm.

Rapid changes in weather conditions (wind, temperature, snowfall) cause snowpack adjustments. Such adjustments may affect snowpack stability and cause an avalanche. Therefore, be alert to weather changes.

Wind. Sustained winds of 15 miles per hour and over rapidly increase the danger of an avalanche occurring. Snow plumes from ridges and peaks indicate that snow is being moved onto leeward slopes. This can create dangerous conditions.



Snow is deposited on leeward slope and forms slabs.

Storms. A high percentage (about 80 percent) of all avalanches occur during, and shortly after, storms. Be extra cautious during these periods. Loose, dry snow slides easily. Moist, dense snow tends to settle rapidly, but during windy periods can be dangerous.

Rate of snowfall. Snow falling at the rate of 1 inch per hour or more rapidly increases avalanche danger.

Crystal types. Observe general snow-crystal types by letting them fall on a dark ski mitt or parka sleeve. Small crystals—needles and pellets—result in more dangerous conditions than the usual, star-shaped crystals.

General Observations.—Look for signs of recent avalanche activity and old slide paths; listen for sounds and cracks; be alert to snow conditions.

Recent avalanche activity. If you see new avalanches, suspect dangerous conditions. Beware when snowballs or "cartwheels" roll down the slope.

Old slide paths. Generally, avalanches occur in the same areas. Watch for avalanche paths. Look for pushed-over small trees, trees with limbs broken off. Avoid steep, open gullies, and slopes.

Sounds and cracks. If the snow sounds hollow, particularly on a leeward slope, conditions are probably dangerous. If the snow cracks and the cracks continue to form, this indicates slab avalanche danger is high.

New snow. Be alert to dangerous conditions with 1 foot or more of new snow.

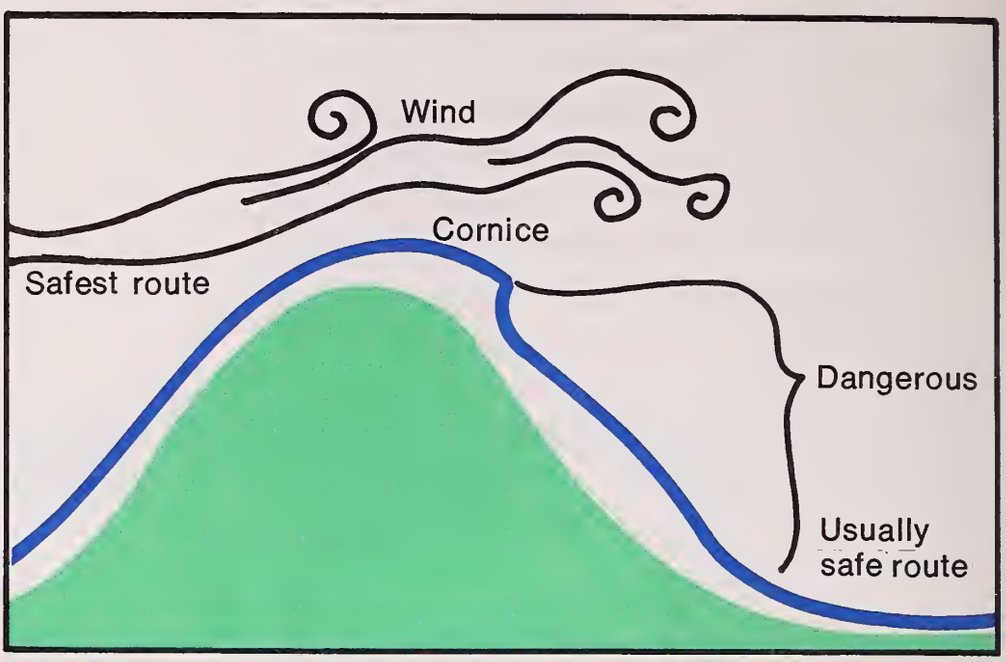
Old snow. When the old snow depth is sufficient to cover natural anchors—such as rocks and brush—additional snow layers will slide more readily. The nature of the old snow surface is important. Rough surfaces favor stability; smooth surfaces, such as sun crusts, are less stable. A loose, underlying snow layer is more dangerous than a compacted one. Check the underlying snow layer with a ski pole, ski, or rod.

Wet snow. Rainstorms or spring weather with warm winds and cloudy nights can warm the snow cover. The resulting free and percolating water may cause wet snow avalanches.

Wet snow avalanches are more likely on south slopes and slopes under exposed rock.

Information.—Check the local weather forecasts. Contact the Forest Service snow ranger or the nearest winter sports area ski patrol.

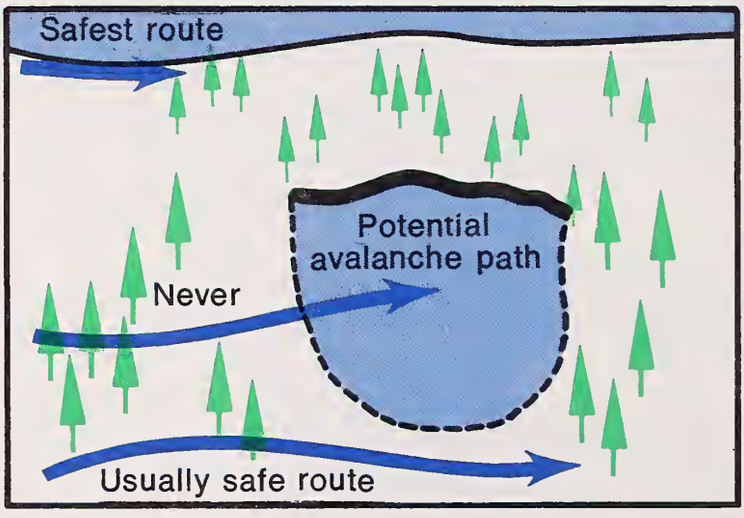
Route Selection and Precautions.—The safest routes are on ridgetops and slightly on the windward side, away from cornices. Windward slopes are usually safer than leeward slopes. If you cannot travel on ridges, the next safest route is out in the valley, far from the bottom of slopes.



Avoid disturbing cornices from below or above. Gain ridgetops by detouring around cornice areas.

If you must cross dangerous slopes, stay high and near the top. If you see avalanche fracture lines in the snow, avoid them and similar snow areas.

If you must ascend or descend a dangerous slope, go straight up or down; do not make traverses back and forth across the slope.



Take advantage of areas of dense timber, ridges, or rocky outcrops as islands of safety. Use them for lunch and rest stops. Spend as little time as possible on open slopes.

Snowmobiles should not cross the lower part of slopes. Do not drive a snowmobile across especially long open slopes or known avalanche paths.

Obey signs closing slopes due to avalanche danger. Only one person at a time should cross a dangerous slope. All others should watch him. Remove ski pole straps, ski safety straps, loosen all equipment, put on mitts, cap, and fasten clothing before you travel in any areas where there is avalanche danger. Carry and use an avalanche cord; carry a sectional probe.

Avalanche Survival.—***If you are caught in an avalanche:***

- Discard all equipment.
- Get away from your snowmobile.
- Make swimming motions. Try to stay on top; work your way to the side of the avalanche.
- Before coming to a stop, get your hands in front of your face and try to make an air space in the snow as you are coming to a stop.
- Try to remain calm.

If you are the survivor:

- Mark the place where you last saw victims.
- Search for victims directly downslope below the last seen point. If they are not on the surface, scuff or probe the snow with a pole or stick.
- You are the victim's best hope for survival.
- Do not desert victims and go for help, unless help is only a few minutes away. Remember, you must consider not only the time required for you to get help, but the time required for help to return. After 30 minutes, the buried victim has only a 50 percent chance of surviving.

If there is more than one survivor:

- Send one for help while the others search for the victim. Have the one who goes for help mark the route so a rescue party can follow back.

- Contact the ski patrol, local sheriff, or Forest Service.
- Administer first aid.
- Treat for suffocation and shock.

Hypothermia

Be aware of the danger of hypothermia—subnormal temperature of the body. Lowering of internal temperature of the body leads to mental and physical collapse.

Hypothermia is caused by exposure to cold, and it is aggravated by wet, wind, and exhaustion. It is the number one killer of outdoor recreationists.

Cold Kills In Two Distinct Steps.— ***The first step is exposure and exhaustion.*** The moment you begin to lose heat faster than your body produces it, you are undergoing exposure. Two things happen: You voluntarily exercise to stay warm, and your body makes involuntary adjustments to preserve normal temperature in the vital organs.

Both responses drain your energy reserves. The only way to stop

the drain is to reduce the degree of exposure.

The second step is hypothermia. If exposure continues until your energy reserves are exhausted, cold reaches the brain, depriving you of judgment and reasoning power. You will not be aware that this is happening. You will lose control of your hands. This is hypothermia. Your internal temperature is sliding downward. Without treatment, this slide leads to stupor, collapse, and death.

The time to prevent hypothermia is during the period of exposure and gradual exhaustion.

Defense Against Hypothermia.— ***Stay dry.*** When clothes get wet, they lose about 90 percent of their insulating value. Wool loses less; cotton, down, and synthetics lose more.

Choose rainclothes that are proof against wind-driven rain and cover head, neck, body, and legs. Polyurethane coated nylon is best. The coatings won't last forever. Inspect carefully and test under a cold shower before you leave home. Ponchos are poor protection from the wind.

Beware of the wind. A slight breeze carries heat away from bare skin much faster than still air. Wind drives cold air under and through clothing. Wind refrigerates wet clothes by evaporating moisture from the surface. Wind multiplies the problem of staying dry.

Take woolen clothing for hypothermia weather. Two-piece woolen underwear, or long wool pants and sweater or shirt. Include a knit cap that can protect neck and chin. Cotton underwear is worse than useless when wet.

Understand cold. Most hypothermia cases develop in air temperatures between 30 and 50 degrees. Most outdoorsmen simply can't believe such temperatures can

be dangerous. They underestimate the danger of being wet at such temperatures—with fatal results.

Fifty degree water is unbearably cold. The cold that kills is cold water running down neck and legs, cold water held against the body by sopping wet clothes, and cold water flushing body heat from the surface of the clothes.

Don't ask, "How cold is the air?" Ask instead, "How cold is the water against my body?"

Use your clothes. Put on raingear ***before*** you get wet. Put on wool clothes ***before*** you start shivering.

End exposure. If you cannot stay dry and warm under existing weather conditions, using the clothes you have with you, end exposure.

Be smart enough to give up reaching the peak or getting the fish or whatever you had in mind.

Get out of the wind and rain. Build a fire. Concentrate on making your camp or bivouac as secure and comfortable as possible. ***Never ignore shivering.*** Persistent or violent shivering is clear warning that you are on the verge of hypothermia.

A stormproof tent gives best shelter. Take plastic sheeting and nylon twine with you for rigging additional foul-weather shelter.

Carry trail food—nuts, jerky, and candy—and keep nibbling during hypothermia weather. Take a gas stove or a plumber's candle, flammable paste, or other reliable firestarters.

Don't wait for an emergency. Use these items to avoid or minimize exposure. Take heed of "hypothermia weather." Watch carefully for warning symptoms. Choose equipment with hypothermia in mind. ***Think hypothermia.***

Forestall exhaustion. Make camp while you still have a reserve of energy. Allow for the fact that exposure greatly reduces your normal endurance.

Be aware that exercise drains energy reserves. If exhaustion forces you to stop, however briefly, your body heat production instantly drops 50 percent or more. Violent, incapacitating shivering may begin immediately, and you may slip into hypothermia in a matter of minutes.

Appoint a foul-weather leader. Make the best-protected member of your party responsible for calling a halt before the least-protected member becomes exhausted or goes into violent shivering.

Symptoms.—If your party is exposed to wind, cold, and wet, ***think hypothermia.*** Watch yourself and others for symptoms.

- Uncontrollable fits of shivering.
- Vague, slow, slurred speech.
- Memory lapses, incoherence.
- Immobile, fumbling hands.

- Frequent stumbling. Lurching gait.
- Drowsiness—to sleep is to die.
- Apparent exhaustion. Inability to get up after a rest.

Treatment.—The victim may deny he is in trouble. Believe the symptoms, not the victim. Even mild symptoms demand immediate, drastic treatment.

- Get the victim out of the wind and rain.
- Strip off all wet clothes.
- If the victim is only mildly impaired, give him warm drinks. Get him into warm clothes and a warm sleeping bag. Well-wrapped, warm (not hot) rocks or canteens will hasten recovery.
- If the victim is semi-conscious or worse, try to keep him awake. Give him warm drinks. Leave him stripped. Put the victim in a sleeping bag with another person—also stripped. If you have a double bag, put the victim between two warm donors. Skin to skin contact is the most effective treatment.
- Build a fire to warm the camp.

Wind Chill

Wind, temperature, and moisture are factors which can greatly affect the safety of a winter traveler. Each contributes to the loss of body heat. The "wind chill" chart illustrates the effect of wind and temperatures on a dry, properly clothed person. If clothing is wet from perspiration or precipitation, the net effect of wind and temperature is much greater.

Dehydration

An adult, at rest, requires 2 quarts of water daily. Up to 4 quarts are required for strenuous activity. There is a 25% loss of stamina when an adult loses 1½ quarts of water. Avoid dehydration—simply drink as often as you feel thirsty.

Wind Speed Cooling Power of Wind Expressed as "Equivalent Chill Temperature"

mph	Temperature (F)											
Calm	40	30	20	10	5	0	−10	−20	−30	−40	−50	−60
	Equivalent Chill Temperature											
5	35	25	15	5	0	−5	−15	−25	−35	−45	−55	−70
10	30	15	5	−10	−15	−20	−35	−45	−60	−70	−80	−95
15	25	10	−5	−20	−25	−30	−45	−60	−70	−85	−100	−110
20	20	5	−10	−25	−30	−35	−50	−65	−80	−95	−110	−120
25	15	0	−15	−30	−35	−45	−60	−75	−90	−105	−120	−135
30	10	0	−20	−30	−40	−50	−65	−80	−95	−110	−125	−140
35	10	−5	−20	−35	−40	−50	−65	−80	−100	−115	−130	−145
40	10	−5	−20	−35	−45	−55	−70	−85	−100	−115	−130	−150
	Danger			Increasing Danger (Flesh may freeze within 1 min.)				Great Danger (Flesh may freeze within 30 seconds)				

Example: At 10°F, a 25 mph wind speed produces a −30°F chill temperature.

Frostbite

Frostbite is caused by exposure of inadequately protected flesh to subfreezing temperatures. Tissue damage is caused by the reduced blood flow to the extremities as opposed to hypothermia, which causes lowering of the body's rate of metabolism.

Symptoms.—Loss of feeling and a dead white appearance.

Treatment.—Restore body temperature as rapidly as possible, preferably by immersion in a water bath of less than 110° temperature or by other means. If necessary to continue moving, the affected part should be kept covered and the victim moved to a location where effective treatment and vehicle evacuation can be obtained.

Prevention.—Party members should periodically observe their companions, especially nose and cheeks for signs of frostbite. Snowmobilers,

due to their speed of travel, are particularly susceptible to frostbite.

Altitude Sickness

At 10,000 feet, air contains only two-thirds of the volume of oxygen that it does at sea level. In addition, the higher air pressure at sea level easily forces the available oxygen through the thin lining of the lungs into the bloodstream. At higher elevations there is less air pressure and the available oxygen is not so easily forced through the lung walls.

Symptoms.—Listlessness, loss of appetite, weakness, apathy, nausea, dizziness, and drowsiness.

Treatment.—Stop and rest, breathe deeply a few times, obtain nourishment from simple sugar, like candy or fruit juices. Travel to lower elevations.

Prevention.—Keep in good physical condition and eat a well-balanced diet. Avoid sudden trips to high altitudes which involve immediate physical exercise.

Hyperventilation

Symptoms.—This reaction to altitude is caused by too rapid breathing and decrease of the carbon dioxide level in the blood, causing lightheadiness and cold feeling. Victims are apprehensive and excited.

Treatment.—Calm the victim, have him relax and breathe into a glove, bag, or hat until normal breathing is restored.

Prevention.—Same as altitude sickness.

Lost or Injured

Avoid becoming lost by taking a good map. Learn to read a compass and believe it. Check weather forecasts and avoid storms. It is easy to become disoriented in the whiteouts

of winter, and when physically exhausted.

If You Are Lost, Injured, Or Your Equipment Has Failed.—Keep calm. Decide on a plan. Trust your compass. Backtrack, if possible. If impractical, remain in place. Stay together, if possible. If not, send at least two people for help.

Don't abandon your snowshoes or skis. Build a fire and shelter. Stay warm.

Mark your base camp so it is visible from the air.

Distress Signals.—Three smokes, three blasts of a whistle, three shouts, three flashes of light, three of anything that will attract attention.

Overdue Party

When Someone Is Overdue.—Keep calm. Notify the County Sheriff or District Ranger in the trip area. Either of these will take steps to alert or activate the local search and rescue organization. If the missing person returns later, be sure to advise the Sheriff or Ranger.

Ground To Air Signals.—Visible emergency signals are easily made in large open areas. SOS can be stamped in snowfields or grassy meadows. Brush piles or evergreen boughs can also be used. Listed below is the emergency code for ground to air signals.

Require doctor–serious injury

Require medical supplies

Require food and water

Am proceeding in this direction

No–negative

Yes–affirmative

All well

Unable to proceed

WAX CHART

Snow	Temperature	° F	° C	Wax Color
Freshly fallen snow in which you can still see the orignal structure.	Extremely cold	15	–11	Light (or special) Green
	Very cold	20	–7	Green
	Cold	30	–1	Blue
	Transitional: thaw/freeze	34	1	Purple
	Thawing	40	5	Yellow
	Warm			Red Klister
Older snow, either packed or settled, which has never melted but does not show crystal structure	Extremely cold	–15	–11	Green
	Cold and very cold	30	–1	Blue
	Transitional: thaw/freeze	34	1	Purple
	Thawing	40	5	Red
	Warm			Red Klister
Ice, corn snow, and slush	Frozen	25	–4	Blue Klister
	Freezing	34	1	Purple Klister
	Melting			Red or Silver Klister

Notes:

1. Traction and adhesion of snow to skis vary according to type of snow and temperature. This chart has been developed as a guideline for selecting the appropriate wax for a given snow condition.
2. This is a general chart good for Rex, Rode, Swix, Toko, and some other brands. For more detail, consult your dealer.
3. When in doubt, use the colder, harder wax first.
4. Thin layers are better than thick. If you need more, add another thin layer.

GENERAL BIBLIOGRAPHY OF WINTER RECREATION SAFETY INFORMATION

It is important to remember that there are practical and technical aspects that affect the enjoyment and enrichment of ski touring—to say nothing of the safety and well-being of the participants—and most of the basic aspects have been covered in depth and detail in the growing volume of ski touring literature.

The bibliography that follows is by no means complete. It is designed to provide a general list of reference material for the would-be or beginning winter recreationist.

Avalanches

Fraser, Colin.
1966. The avalanche enigma. Rand McNally and Co., Chicago, Ill.

Gallagher.
1967. Snowy torrents—avalanche accidents in the U.S. 1910–1966. Alta Avalanche Study Cent., Ogden, Utah.

LaChappelle, E.R.
1970. The ABC of avalanche safety. 2d ed., rev. E. R. Highlander Publ. Co.

Perla, Ronald I., and Mario Martinelli, Jr.
1976. Avalanche Handbook. U.S. Dep. Agric., Agric. Handbk. 489.

Williams, Knox.
1975. The snowy torrents: avalanche accidents in the United States 1967–1971. Gen. Tech. Rep. RM-8. U.S. Dep. Agric., For. Serv.

Basic Ski Touring

Baldwin, Edward R.
1972. The cross-country skiing handbook. Charles Scribner's Sons, New York.

Brady, Michael.
1971. Nordic touring and cross-country skiing. Dreyers Forlog, Oslo, Norway.

Brady and Skijemstad.
1971. Waxing. Eiger Mountain Sports, San Fernando, Calif.

Brower, David, ed.
1962. The Sierra Club manual of ski mountaineering. Charles Scribner's Sons, New York.

Brower, David, ed.
1969. Manual of ski mountaineering. 4th ed. The Sierra Club, San Francisco, Calif. Ballantine Books, New York.

Brunner, Hans.
1972. Cross-country skiing. McGraw-Hill, Ryerson, New York.

Caldwell, John.
1973. The new cross-country ski book. The Stephen Green Press, Brattleboro, Vt.

Davidson, Paul, and Robert Fuller.
1968. Skiers exercise book, a guide for conditioning. A. S. Barnes and Co., Cranberry, N.J.

International Orienteering Federation.
[n.d.] The complete guide to cross-country skiing and touring. Holt, Rinehart and Winston, Inc., 383 Madison Ave., New York.

Lederer, William J., and Joe Pete Wilson.
1972. Complete cross-country skiing and ski touring. rev. W. W. Norton and Co., Inc., New York.

Lund, Horton.
1972. The pleasures of cross-country skiing. Outerbridge and Lazard, New York.

Manning, Harvey, ed.
1974. Mountaineering, the freedom of the hills. The Mountaineers, Seattle, Wash.

Osgood, William E., and Leslie J. Hurley.
1969. Ski touring, an introductory guide. C. E. Tuttle Publ. Co., Rutland, Vt.

Painter.
1973. The cross-country ski cook, look and pleasure book. Wilderness Press, Berkeley, Calif.

Rusin, Bill.
[n.d.] Ski touring for the beginner. Silva, Inc., La Porte, Ind.

Ski Touring Council Inc.
1975. The ski touring guide.
Ski Touring Council. Troy, Vt. 05868

Steck, Allen, and Lito Tejada-Flores.
1972. Wilderness skiing. Sierra Club Books, 597 5th Ave., New York. 10017

Tinker, Gene.
1971. Let's learn ski touring, your guide to cross-country fun. [for children] Walker and Co., New York.

Tobey Publishing Co.
[n.d.] XC Cross country skiing. Tobey Publ. Co., Box 428, New Canaan, Conn.

Tokle, Art, and Martin Luray.
[n.d.] The complete guide to cross-country

skiing and touring. Holt, Rinehart and Winston, Inc., 383 Madison Ave., New York.

Map and Compass

Disley, John.
[n.d.] Orienteer. East. Ski Assoc., 22 High St., Brattleboro, Vt.

Kjellstrom, Bjorn.
1967. Be expert with map and compass. Am. Orienting Serv., LaPorte, Ind.

The MacMillan Co.
1967. The wilderness route finder. The MacMillan Co., New York.

U.S. Army.
1965. Map reading. U.S. Army, FM–21–26. [May be found in campus bookstores.]

U.S. Geological Survey.
[n.d.] Reading U.S.G.S. maps. U.S. Geol. Surv., Map Sales, Bldg. 41, Denver Fed. Cent., Denver, Colo. 80225

U.S. Geological Survey.
[n.d.] State index to topographic maps. U.S. Geol. Surv., Map Sales, Bldg. 41, Denver Fed. Cent., Denver, Colo.

Winter First Aid and Mountain Medicine

Bleything, Dennis, and Ronald L. Dawson.
1971. Primitive medical aid in the wilderness. Life Support Technology, Inc., Beaverton, Oreg. 97005

Darvill, Fred T., Jr., M.D.
1969. Mountaineering medicine. Skagit Mountain Rescue Unit, Mt. Vernon, Wash. [A wilderness medical guide, paperback.]

Kodet, E.
1968. Being your own wilderness doctor. Stackpole Books, Harrisburg, Pa.

Lathrop, Theodore, M.D.
1972. Hypothermia: killer of the unprepared. Mazamas, Portland, Oreg.

MacInnes, Hamish.
1973. International mountain rescue handbook. Charles Scribner's Sons, New York.

Manning, Harvey, ed.
1974. Mountaineering first aid. Reprint from "Mountaineering, the Freedom of the Hills." The Mountaineers, Seattle, Wash. [An excellent pamphlet to carry in your backpack, with your first aid kit, paperback.]

Meyer, Seymour.
1967. Functional bandaging, including splints and protective dressings. Am. Elsevier Publ. Co., New York.

SAFECO Insurance Company.
[n.d.] Four lines of defense against hypothermia. SAFECO Ins. Co., P.O. Box 5687, Denver, Colo. 80217

Starkov, P.
1960. The problem of acute hypothermia. Pergamon Press, New York.

Washburn, Bradford.
1970. Frostbite, what it is—how to prevent it—emergency treatment. Museum of Science, Boston.

Wilderson, J. P., M.D.
1973. Medicine for mountaineering. The Mountaineers, Seattle, Wash.

Winter Travel and Survival

Adirondack Mountain Club, Inc.
[n.d.] Winter hiking and camping. Adirondack Mountain Club, Inc., R.D. 1, Ridge Road, Glen Falls, N.Y. 12801

Berglund, Berndt.
1972. Wilderness survival: a complete handbook and guide for survival in the North American wilds. Charles Scribner's Sons, New York.

Bleything, Dennis, and Ronald L. Dawson.
1972. Edible plants in the wilderness. Life Support Technology, Inc., Manning, Oreg. 97125

Bleything, Dennis, and Ronald L. Dawson.
1974. Poisonous plants in the wilderness.

Life Support Technology, Manning, Oreg. 97125

Burt, Calvin P., Ronald L. Dawson, and Frank G. Heyl.
1974. Survival in the wilderness. Life Support Technology, Inc., Manning, Oreg. 97125

Bridge.
1973. The complete snow camper's guide. Charles Scribner's Sons, New York.

Colorado Division of Wildlife.
[n.d.] Survival manual. Colorado Division of Wildlife, 6060 Broadway, Denver, Colo. 80216

Dawson, Ronald L.
1975. Edible plants cards—temperate North America. Life Support Technology, Inc., Manning, Oreg. 97125

Fear, Eugene.
1970. Outdoor living: problems, solutions, guidelines. Tacoma Unit of Mountain Rescue Council, Tacoma, Wash. [paperback]

Fear, Eugene.
1973. Surviving the unexpected wilderness emergency. Survival Education Assoc., Tacoma, Wash.

Graves, Richard H.
1972. Bushcraft: a serious guide to survival and camping. Schocken Books, New York.

Hitchcock and Fox.
1973. Making it. Livingston Publ. Co., Wynnewood, Pa.

Merrill, William K.
1972. The survival handbook. Winchester Press, New York.

Osgood, William E., and Leslie J. Hurley.
[n.d.] The snowshoe book. Stephen Greene Press. Brattleboro, Vt. [paperback]

U.S. Department of Agriculture, Soil Conservation Service.
1965. Survival in snow. U.S. Dep. Agric. Soil Conserv. Serv., Portland, Oreg.

Regional Guidebooks, United States Ski Association

Most of the divisional offices of the United States Ski Association maintain current lists of these guidebooks for their region. For specific areas we suggest you contact the USSA divisional office in your region:

Northeast:	Eastern Ski Association 22 High Street Brattleboro, Vt. 05301
Midwest:	Central Division— USSA, P.O. Box 66014 AMF O'Hare, Chicago, Ill. 60666
Inter-mountain:	c/o Rob Kiesel Box 319 Ketchum, Idaho 83440
Southern Rocky Mountain:	Rocky Mountain Division— USSA, 1463 Larimer Square Denver, Colo. 80202
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Regional Offices, Forest Service, U.S. Department of Agriculture

National Forest maps and information can be obtained by contacting Regional, Forest Supervisor,

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